**MAI-2005-21**

**UNITED STATES**
**DEPARTMENT OF LABOR**
**MINE SAFETY AND HEALTH ADMINISTRATION**
**Metal and Nonmetal Mine Safety and Health**

REPORT OF INVESTIGATION

Surface Nonmetal Mine
(Crushed Limestone)

Fatal Powered Haulage Accident
August 13, 2005

Tarmac America, LLC
Pennsuco Quarry
Medley, Dade County, Florida
Mine I.D. No. 08-00931

Investigators

Wyatt S. Andrews
Supervisory Mine Safety and Health Inspector

Jose J. Figueroa
Mine Safety and Health Inspector

Terry E. Phillips
Mine Safety and Health Specialist

F. Terry Marshall
Mechanical Engineer

Originating Office
Mine Safety and Health Administration
Southeastern District
135 Gemini Circle, Suite 212; Birmingham, AL 35209
Michael A. Davis, District Manager

## OVERVIEW

Jose R. Salgado, truck driver, age 56, was fatally injured on August 13, 2005, when the haulage truck he was operating traveled over a berm and entered a water filled pit.

The accident occurred because the task training provided was inadequate and did not ensure that the newly hired miner could safely operate the haul truck.

## GENERAL INFORMATION

Pennsuco Quarry, a crushed limestone operation, owned and operated by Tarmac America, LLC was located in Medley, Dade County, Florida. The principal operating official was John Hoyer, plant manager. The mine operated two, 8 to 10 hour shifts a day, six days a week. Total employment was 199 persons.

Limestone was drilled and blasted from a single bench into a water filled pit where it was removed by a drag line and stockpiled to dry. Front end loaders loaded the material into haulage trucks which transported the shot rock to a primary crusher, where it was crushed and conveyed to the plant for sizing. The finished products were conveyed to an adjoining cement plant. Some of the material was sold locally for use in the construction industry.

The last regular inspection at this operation was completed on July 21, 2005.

## DESCRIPTION OF THE ACCIDENT

On the day of the accident, Jose R. Salgado (victim) reported for work at 4:40 a.m., his normal starting time. Salgado met with other day shift employees at the break room and attended a safety meeting conducted by Mario Suarez, lead man.

Suarez assigned Salgado to drive a Caterpillar 777C model truck because the regular driver was absent. Salgado previously trained on Caterpillar 777B and 777D model trucks. About 5:10 a.m., Salgado performed a pre-operational inspection of the haul truck. Salgado and four other truck drivers drove their trucks to the pit where they were loaded by two front-end loaders. They traveled to the crusher 1.4 miles from the pit to dump their loads.

After completing ten to twelve round trips, Salgado stopped at an office at the crusher and delivered his pre-operational inspection report to Lorenzo Aday, plant operator. At 8:40 a.m., Aday received a call from one of the drivers who indicated a haul truck had struck the bank on the down ramp. Aday contacted Pedro Velasco, maintenance supervisor, who contacted the haul truck drivers. When it was determined that one of the trucks was missing, Velasco met George Moralis, truck driver. They went to the bottom of the down ramp at 8:47 a.m. The haul truck Salgado was operating had struck the dirt bank on the right side of the down ramp. The truck traveled back across the roadway and went over the berm on the left side of the ramp into the water filled pit.

Emergency medical personnel and underwater divers arrived at 9:03 a.m.

Salgado was brought to the surface where the efforts to revive him failed. Salgado was transported by helicopter to a hospital where the Dade County Coroner pronounced him dead at 10:01 a.m. Death was attributed to drowning.

## INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident at 10:15 a.m. (CST) on August 13, 2005, by a telephone call from the Tarmac safety manager, to Wyatt S. Andrews, supervisory mine safety and health inspector. An investigation was started the same day. An order was issued under the provisions of Section 103(k) of the Mine Act to ensure the safety of the miners. MSHA's accident investigators traveled to the mine, made a physical inspection of the accident scene, conducted interviews, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management, employees, and contractor personnel.

## DISCUSSION

### Accident Location

The accident occurred near the bottom of an inclined road, approximately 800 feet from the primary crusher. From the primary crusher, the roadway was level for 300 feet to the crest of the exit roadway. The inclined section of this roadway was 600 feet long with an 8 to 15 percent grade. The roadway was 27 feet wide with a 10-foot high dirt bank on one side and a 7-9 feet high berm on the side adjacent to a water filled pit. At the base of the inclined section, approximately 900 feet from the primary crusher, the haul road widened and could accommodate two way traffic to the pit a mile away. The roadways entering and leaving the crusher area were used for one way travel.

The truck struck the side bank, with the right front tire, approximately 500 feet from the crest of the roadway. The grade in this area was approximately 8 percent. The roadway was dry and there were no skid marks from braking. The truck's speed at the time the truck struck the bank and berm could not be determined.

### Weather

At the time of accident, the weather was clear, with no wind and a temperature of 80 degrees Fahrenheit.

## Haul Truck

The haul truck involved in the accident was a 1993 Caterpillar 777C, equipped with a dump bed, a Caterpillar 3508 EUI diesel engine with a gross power rating of 920 horsepower, and a 7 speed automatic transmission. Caterpillar lists the empty weight of the model 777C as approximately 136,000 pounds.

The truck was submerged in the water filled pit for 27 days before being recovered. It had substantial water damage that prevented the engine from being operated. All system tests were conducted using remote air and hydraulic pressure sources and secondary steering pressure as required. No visual damage to the braking and steering systems was identified. Electrical repairs were made to test the braking and steering systems.

The haul truck was 32 feet, 1 inch long and had a wheelbase of approximately 15 feet. The truck's track width was 16 feet, 7 inches with a rear mid-axle height of approximately 4 feet, 3 inches. A blind area of approximately 15-20 feet existed around the right front corner of a similar model machine as observed from the operator's seat when trying to view objects approximately five feet above the ground.

## Air System

The air system did not sustain any visible damage during the accident. Tests indicated the truck had a leak rate of approximately 2 pounds per square inch (psi) per minute with the engine off. The source of the leak was determined to be the drain valve for the parking and secondary brake release air tank. The investigation determined that this defect did not contribute to the accident.

## Service Brake System

The truck had a dual-circuit air over hydraulic service brake system (one hydraulic circuit for the steering axle service brakes and one hydraulic circuit for the drive axle service brakes). It had air over hydraulic-applied service brakes at all four wheels with enclosed wet disc type brakes on the steering axle (front brakes) and on the drive axle (rear brakes). The service brakes were modulated by a foot pedal.

The air supply line for the air over hydraulic brake converter for the front brakes was found to be disconnected and plugged off at a fitting connection near the

brake converter. No supply air was getting to the brake converter when the service brake foot pedal was applied. The investigators determined that this defect did not contribute to the accident and a non-contributory citation was issued. The supply line was re-connected to the front brake converter and investigators determined that the air portion of the brake converter had an air leak. Tests indicated that the truck had a leak rate of approximately 10 psi per minute with a supply line to the front brake converter re-connected, the service brakes fully applied, and the engine off.

The air over hydraulic brake converter for the rear brakes functioned properly when tested. The hydraulic pressure for the rear brakes was approximately equal to the 6.6 to 1 output ratio of the rear brake converter stated in the service manual[1]. Testing indicated that the rear tires skidded on a hard packed rock surface when the truck was pushed and the service brakes fully applied using the foot pedal.

[1]Caterpillar Form No. SENR5610, October 1992, page 21.

## Retarder

The retarder system on this truck used both the front and rear wet disc brakes (air over hydraulic service brakes) and was controlled by modulating a hand control lever on the right side of the steering column underneath the steering wheel. The hand lever modulated the brake pressure to the rear service brakes when tested. The retarder system used the same brake converters as the service brake system. The plugged air line for the front brake converter made the front brakes inoperative during retarder operation.

## Secondary Brakes

The haul truck had a secondary brake system which was controlled by modulating a hand control lever on the left side of the steering column underneath the steering wheel. This brake system actuated the air over hydraulic front service brakes and the spring applied parking brakes on the rear wheels. The hand lever modulated the air pressure to the front brake converter and the parking brake hydraulic release pressure when tested; however, the secondary brake system used the same front brake converter as the service brake system. The plugged air line for the front brake converter made the front brakes inoperative during secondary braking.

## Parking Brake System

The parking brake system was a spring-applied, hydraulic release system that used the same wet brake disc pack as the service brakes at each of the two rear wheels. A flip switch mounted on the center console set and released the parking brake. No defects were detected during testing of the parking brakes. The switch operated the release pressure for the parking brakes when the system release pressure was supplied using a remote hydraulic pack.

The investigation determined that the braking systems provided on this Caterpillar 777C truck would have provided the truck operator with the necessary braking ability to control the truck at the time of the accident.

## Steering Systems

The truck was equipped with a hydraulic steering system and a secondary steering system that provided electric over hydraulic pressure for the steering controls in the event of an engine shutdown.

The steering system was visually inspected and determined to be hydraulically and mechanically intact. The electric driven hydraulic pump for the secondary steering system functioned when tested with the manual switch and was used to test the steering system. No problems were identified with the steering system that would have affected the ability of the truck driver to control the truck at the time of the accident.

## Transmission

The truck had a seven-speed automatic transmission with electronic shift control. The transmission selector lever was found in the seventh gear position. In this position and with the maximum gear setting at seventh gear, the transmission would automatically up shift and downshift throughout this speed range (first through seventh), depending on rear wheel speed and engine RPM, without requiring the operator to manually shift the selector lever. Product literature indicated that the maximum machine speed in seventh gear was approximately 38 miles per hour.

## Engine Throttle Control

The engine throttle was electronically controlled and could not be tested due to the electrical problems encountered during the field evaluation and the inability to run the engine. The mechanical portion of the foot operated throttle pedal was tested and no binding or sticking was observed.

**Warning Light Indicators**

The dash board panel warning lights were tested before the electrical problems were encountered. All of the warning lights lit when the panel test switch was placed in the on position.

**Seat Belt**

A functional seat belt was provided for the operator's seat.

**Tires and Tire Pressures**

The two tires on the front axle (steering axle) were 27.00R49 Bridgestone R Lug S tubeless radials with a two star rating. The four tires on the rear axle (drive axle) were 27.00R49 Goodyear RL-4 tubeless radials with a two star rating. A representative from GCR Tire, a contractor responsible for the mine's tire maintenance, measured the tire pressures (Table 1) for the truck. The tire pressures were measured with an ambient temperature estimated at approximately 95° F. The representative stated that tires on this type of truck typically operate with approximately 100-110 psi in the front and the rear tires.

Table 1

| | Left Side | | Right Side | |
|---|---|---|---|---|
| Front Axle | 113 psi | | 110 psi | |
| | Outer Dual | Inner Dual | Inner Dual | Outer Dual |
| Rear Axle | 120 psi | 110 psi | 55 psi | 108 psi |

## TRAINING AND EXPERIENCE

Jose R. Salgado had 13 days mining experience and 4 days experience driving haul trucks, all at this operation. He had received 24 hours of new miner training and 24 hours of task training.

## ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following causal factors were identified:

**Causal Factor:** Management policies, standards, and controls were inadequate and failed to ensure that employees received task training in the health and safety aspects and safe work procedures related to operating haul trucks. The drivers who trained the victim did not know the proper use of the retarder and brake systems to control the speed of the haul truck while traveling on down grades.

**Corrective Action:** Management should develop and establish procedures to ensure that equipment operators are task trained to safely operate mobile equipment. Equipment operators should consult the operator's manual for proper procedures prior to performing tasks. Management should monitor employees to ensure that training is adequate. Instructors should be knowledgeable of the safe operating procedures of the mobile equipment they are training employees to operate.

**Causal Factor:** Management did not ensure that mobile equipment operators were wearing seat belts when operating mobile equipment.

**Corrective Action:** Procedures should be established which require management to regularly monitor equipment operators for seat belt usage.

## CONCLUSION

The accident occurred because the task training procedures used were inadequate and did not ensure that the victim could safely operate the haul truck. He had no previous experience operating mobile equipment. Competent trainers were not provided because the truck drivers who task trained the victim were unfamiliar with the safe operating procedures of the haul trucks. They lacked knowledge of the retarder and braking systems provided on the haul trucks.

## VIOLATIONS

Order No. 6073500 was issued on August 13, 2005, under the provisions of Section 103(k) of the Mine Act:

> A fatal accident occurred at this operation on August 13, 2005, when the driver of a Caterpillar model 777 haul truck lost control of the vehicle and ran off the primary crusher roadway in an area approximately 750 feet west of the primary crusher. This order is issued to ensure the safety of all persons at this operation. It prohibits all activity at the west primary crusher roadway until MSHA has determined that it is safe to resume normal operations in this area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and/or restore operations to the affected area.

This order was terminated on September 4, 2005. The conditions that contributed to the accident have been corrected and normal mining operations can resume.

Citation No. 6088171 was issued on October 19, 2005, under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 46.7(a):

A fatal accident occurred at this mine on August 13, 2005, when a haul truck left the roadway while descending a ramp, traveled over a berm, and fell into a water filled pit. The victim had not been instructed in the health and safety aspects and safe operating procedures for the haul truck he was operating. The truck drivers assigned by management to task train the victim were, themselves, not provided with specific written information regarding operational safety features of the haul truck. They were not familiar with the proper use of the brake retarder lever and the service brake to reduce the speed of the truck while traveling down grades. Therefore, they did not teach these procedures to the victim.

This citation was terminated on November 16, 2005. All truck drivers received additional task training using the operator's manual for the Caterpillar 777 haul truck. Training was also conducted by a Caterpillar representative regarding the safe operation of the haul trucks.

Citation No. 6088172 was issued on October 19, 2005, under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 56.9101:

A fatal accident occurred at this mine on August 13, 2005, when a haul truck left the roadway, traveled over a berm, and fell into a water filled pit. The driver failed to maintain control of the truck while operating it on a downhill ramp at the mine.

This citation was terminated on November 16, 2005. All truck drivers received additional task training using the operator's manual for the Caterpillar 777 haul truck. Training was also conducted by a Caterpillar representative regarding the safe operation of the haul trucks. Signs were posted at the top of the downhill ramp to warn drivers of the hazards of excessive speed.

Citation No. 6088173 was issued on October 19, 2005, under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 56.14131(a).

A fatal accident occurred at this mine on August 13, 2005, when a haul truck left the roadway, traveled over a berm, and fell into a water filled pit. The seat belt provided in the haul truck was not being worn by the operator at the time of the accident.

This citation was terminated on November 16, 2005. All truck drivers were re-instructed on the use of seat belts while operating mobile equipment. A program has been put in place by management to monitor the use of seat belts.

Approved by: _____ Date: _____
Michael A. Davis
District Manager

## APPENDIX A

**Persons Participating in the Investigation**

**Tarmac America, LLC**

| | |
|---|---|
| John Hoyer | aggregate manager |
| Jeff Harris | assistant aggregate manager |
| Sherrin Burks | safety manager |
| Jesus Mora | quarry foreman |
| Mario Suarez | lead man |
| Gerald L. Cooper | maintenance superintendent |
| Carlos Odriozola | maintenance foreman |
| Lorenzo Aday | tower operator |
| George Moralis | truck driver |
| Freddie Gonzales | truck driver |
| Pedro Velasco | maintenance foreman |
| Jorge Leyva | truck driver |
| Luis Saoane | FEL operator |
| Elvio Cantallopos | truck driver |
| Eddy Vierra | FEL operator |
| Adel Garcia | truck driver |
| John Hawkins | truck driver |

**Kelly tractor**

| | |
|---|---|
| Charles Calais | service manager |
| Carlos Araujo | service technician |

**Mine Safety and Health Administration**

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|---|---|
| Wyatt S. Andrews | supervisory mine safety and health inspector |
| Jose J. Figueroa | mine safety and health inspector |
| John D. Reed | mine safety and health inspector |
| Terry E. Phillips | mine safety and health specialist |
| F. Terry Marshall | mechanical engineer |